HARD RED SPRING AND DURUM WHEATS

Culture and Varieties

Farmers' Bulletin No. 2139

U.S. DEPARTMENT OF AGRICULTURE

Information in this bulletin is based on data obtained primarily from (1) varietal experiments conducted in cooperation with State agricultural experiment stations, (2) classification studies of American wheat varieties, (3) a survey of wheat varieties grown in the United States in 1954, (4) several years of observations by the authors, and (5) milling and baking experiments conducted in cooperation with State agricultural experiment stations and certain commercial agencies.

CONTENTS

THIS BULLETIN SUPERSEDES FARMERS' BULLETIN 1902, VARIETIES OF SPRING WHEAT FOR THE NORTH CENTRAL STATES

Washington, D.C. Issued August 1959

For sale by the Superintendent of Documents, U. S. Government Printing Office
Washington 25, D. C. - Price 15 cents

Hard Red Spring and Durum Wheats • *Culture and Varieties*

By E. R. AUSEMUS, agronomist, and R. M. HEERMAN, formerly agronomist, Crops Research Division, Agricultural Research Service

Where spring wheat is grown

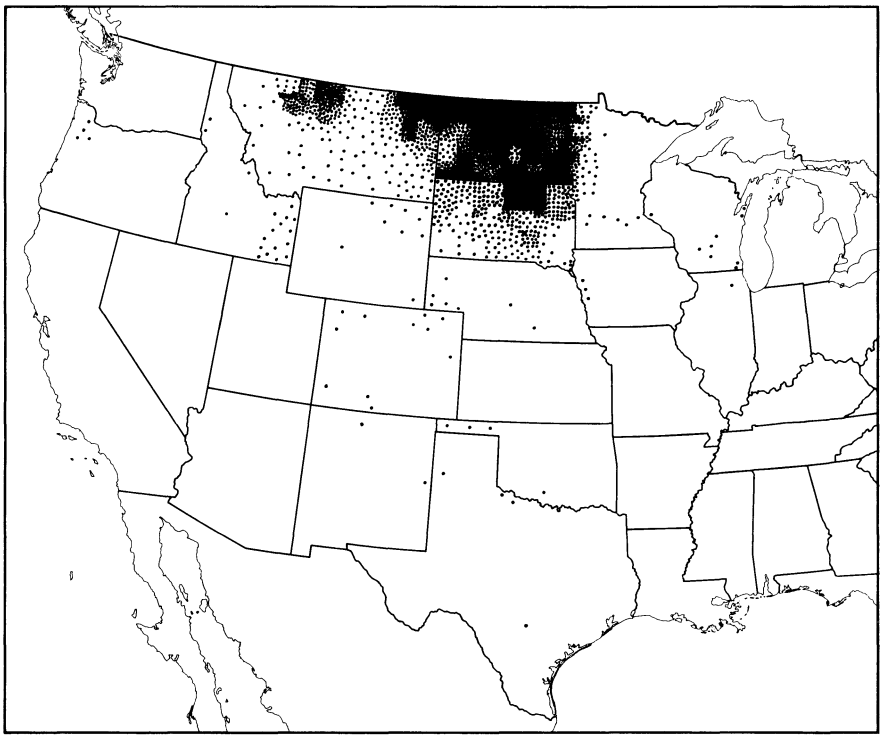
Varieties of spring wheat belong to three market classes—hard red spring, durum, and white wheat. Hard red spring wheat and amber-colored durum are by far the most important in the spring wheat region.

The principal hard red spring wheat States are North Dakota, Montana, South Dakota, and Minnesota. These States, together with Colorado, Wyoming, Wisconsin, Nebraska, and Iowa, comprise the spring wheat region. Other States grow a small acreage of spring wheat in some years. Of these States, Oklahoma, New Mexico, and Texas are in the hard red winter wheat region; Pennsylvania, Ohio, Indiana, Illinois, Michigan, Missouri, Virginia, and Tennessee are in the soft red winter wheat region; and Washington, Oregon, and Idaho are in the western wheat region.

Hard Red Spring Wheat.—Hard red spring wheat varieties occupy about 20 percent of the total wheat acreage of the United States. About 13¼ million acres were sown in 1954, according to data obtained in the national wheat variety survey made that year (fig. 1).[1] The choice of varieties has changed rapidly since 1950 because of severe damage by leaf and stem rust, particularly stem rust race 15B.

Durum Wheat.—About 1.5 million acres of durum wheat were grown in 1954, mostly in North and South Dakota and Minnesota (fig. 2). This was about 5 percent of the total wheat acreage. Severe damage by stem rust race 15B caused a reduction in durum wheat acreage for a few years following 1950. Production increased to about 2.4 million acres in 1956. Seed of improved varieties became available about this time and grain for semolina was grown in other States and regions. About 270,000 acres were grown in Montana in 1955, and nearly three times this much in 1956. About 13,500 acres of durum were grown in Texas in 1954. Normally all the Texas-grown durum is used for feed.

[1] The Department of Agriculture makes a national wheat variety survey at 5-year intervals.



BN–7561

FIGURE 1.—Distribution of hard red spring wheat in 1954. 13,248,404 acres. 1 dot=5,000 acres.

White Wheat.—Most of the white wheat in the spring wheat region is grown in Montana, Colorado, and Wyoming, and it is used mostly for feed. Onas, Baart, and Lemhi are the varieties grown most extensively. The acreage is small.

Importance of spring wheat

Nearly 90 percent of the acreage of wheat in the spring wheat region is hard red spring. The most important and most extensively grown varieties in the region have built the high reputation that hard red spring wheat now holds as high-quality bread wheat. No class of wheat enjoys a more enviable reputation for breadmaking qualities and none is more in demand in the wheat markets of the world.

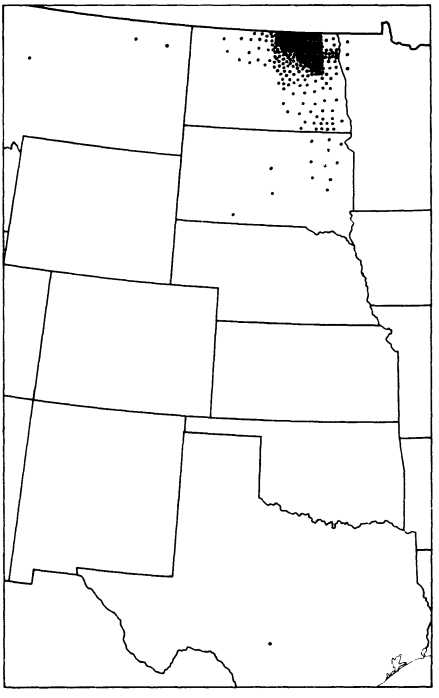
Second in importance is the durum wheat. Varieties of this class are used mostly for making macaroni and other semolina products. Durum wheat, when first grown in the North Central States in the first decade of the century, was especially noted for its resistance to stem rust and because of this characteristic usually produced higher yields than the varieties of hard red spring wheat then available. The production of stem rust-resistant varieties of the latter class removed

this advantage, but durum is still extensively grown because of the macaroni industry's need for it. Approximately 2½ to 3 million acres are required for normal domestic consumption.

Factors affecting choice of varieties

Spring wheats are grown mostly in the northern sections of the United States where climatic conditions are well suited to the growing of spring-seeded crops. The principal States are in areas where annual rainfall averages 14 to 25 inches. Drought and heat frequently reduce the yields of spring wheat, particularly in the western half of the region. Drought and heat may cause the wheat leaves to fire, prevent seed from setting, or cause premature ripening and shrunken grain. Early-maturing varieties may escape injury because they frequently have completed their heading before hot weather occurs and are ripe before the soil moisture is exhausted.

Severe epidemics of stem rust have pushed spring wheat growing westward to the drier areas in the Dakotas where rust is less of a problem. Corn and soybeans have tended to replace wheat in Minnesota, except in northern sections of the State. Diseases in addition to stem rust, and the presence of certain insects, also influence success of the crop and the varieties to grow.



BN–7560

FIGURE 2.—Distribution of durum wheat in 1954. 1,591,172 acres. 1 dot=5,000 acres.

Comparisons between spring and winter wheats

Spring wheat is grown in regions where winter wheat, which must be seeded in the fall, generally does not survive. Where winter wheat varieties can survive the winter, they generally outyield spring wheat varieties because they mature earlier and are more likely to escape damage from hot weather, drought, rusts, and other hazards.

Since fall-sown wheat does not survive the winter in much of the wheat-growing region of the North Central States, it cannot compete successfully with spring wheat. In

certain areas, such as southern Minnesota, southern South Dakota, Wyoming, and central Montana, where both spring and winter wheats are adapted, the growing of both types gives a better distribution of labor and reduces the risk of crop failure.

Spring wheat may be sown on land where winter wheat has been destroyed by winterkilling. It may also be sown on land where winter wheat has been thinned by winterkilling, but this has the disadvantage that the harvested crop may be a mixture of spring and winter wheat and may be graded as mixed wheat.

Winter wheat usually is more productive than spring wheat when grown in the Corn Belt. In the Pacific Northwest and in the Mountain States, both winter and spring wheats are grown extensively and yield well. Under irrigation, spring wheat fits better in the crop rotation and usually is preferred in this region. Spring wheats may be seeded in the fall in California, southern Arizona, and other regions where the winters are mild.

Growing spring wheat

In the Red River Valley of Minnesota and North Dakota, wheat often is grown in these rotations: Wheat, sugar beets, potatoes, sweetclover; wheat, barley, sweetclover; and wheat, sweetclover. In this region wheat often follows corn. Much of the spring wheat, however, follows wheat, oats, barley, flaxseed, winter rye, or fallow, with an occasional intertilled crop or hay crop intervening.

In some of the western drier areas, it is a common practice to sow wheat in strips alternating with fallow. Fallowing conserves and stores moisture for the succeeding crop, and the strips of wheat check soil blowing on the bare fallow.

Spring wheat varieties generally respond best when sown about as early as the land can be tilled. Early seeding gives a better chance for the crop to escape damage from heat, drought, or rust.

Good seedbed preparation is desirable to secure uniform stands and to suppress weeds.

Seeding is done with a grain drill at a rate of 3 to 4 pecks per acre in the drier region and 4 to 8 pecks per acre in the subhumid region. No thicker seeding is necessary for durum wheat. The heads and grains are so large that fewer plants per acre are needed.

Most of the spring wheat is harvested with a combine. Where ripening is not uniform or many green weeds are present, it is a common practice to windrow the grain and later to combine it from the swath. In the drier areas the standing grain is usually combined directly.

Diseases

Rusts, root rots, scab (*Fusarium* blight), loose and covered smut, and wheat streak mosaic are the most destructive diseases in the spring wheat region. Black chaff, leaf blight, and seedling blights also cause losses in some localities.

Rusts.—Stem rust and leaf rust are the most destructive diseases in the humid part of the spring wheat region and may occur in all parts. Stem rust may develop on any part of the plant above the ground but is most conspicuous and destructive on stems. Leaf rust develops principally on the leaves and leaf sheaths. Microscopic parasitic fungi cause both diseases. These fungi grow only on living plants, and the spores may be carried by the wind from infected plants to healthy wheat plants.

Severe stem rust infection results in badly shriveled grain and greatly reduced yields. Sometimes the entire crop is lost. Severe leaf rust infection reduces the number and size of the kernels and reduces the protein content of the grain.

Losses from stem rust can be reduced by destroying certain kinds of barberry plants, which are the alternate host of the rust. Growing resistant varieties in the South would help reduce losses, since rust spores are carried northward by the winds from Texas and Mexico to the wheatfields in Oklahoma and Kansas. Later the rust spreads to the spring wheat region.

Losses from stem or leaf rust can be reduced and are frequently prevented by planting resistant varieties. Early-maturing varieties sometimes escape damage. Neither stem rust nor leaf rust can be controlled by seed treatment. Research workers are trying to find a chemical spray or dust that can be applied economically to control the rusts.

NOTE.—A USDA motion picture on stem rust is available. For information concerning it, see your county agent.

Prior to 1921 no commercially grown hard red spring wheat was highly resistant to the rusts, although certain durum varieties were resistant. Breeding work resulted in the development of several improved bread varieties, such as Ceres, Marquillo, Thatcher, Hope, and H44. Three improved durum varieties, Carleton, Stewart, and Vernum, were more resistant to stem rust than were the older durum varieties. New races of leaf rust that appeared in 1944 in the spring wheat region attacked most of these varieties. All domestic wheat varieties proved to be susceptible to new races of stem rust that prevailed after 1950. Certain varieties now grown appear to have considerable resistance to the new races. Others exhibit tolerance to the rusts—that is, rust development is retarded and the mature crop, while heavily infected, may yet produce a fair yield and high test weight of grain.

Root Rots.—Root rots and basal stem rots are among the least conspicuous but most destructive diseases of wheat. They are caused by many species of fungi that live on or in the seed, soil, and dead-plant refuse. *Helminthosporium*, *Fusarium*, *Pythium*, *Rhizoctonia*, and *Cercosporella* species all contribute to the root rot complex in the spring wheat region.

The underground parts of plants, or parts near the surface of the soil, usually are injured. Root rots are generally accompanied by seedling blight, stunting of plants, yellowing and bleaching of foliage,

discoloration of roots and bases of the stems, and premature killing of adult plants. Temperature, moisture, soil type, date of seeding, and cultural practices determine the extent of injury. The best control methods are the use of good seed, seed treatment, early seeding of spring wheat, growing wheat in rotation with legumes, summer fallowing, and the use of phosphate fertilizer in certain areas.

Scab (*Fusarium* Blight).—The *Fusarium* blight fungus may attack any part of the wheat plant, but it is primarily observed in the field as a head and kernel blight commonly known as scab.

Seedling blight results from the use of infected seed. Diseased seedlings are characterized by a light brown to reddish-brown, water-soaked rot that kills the plants and reduces the field stand. After heading, individual spikes or parts of spikes may be attacked. Spikelets become a bleached straw color and the pink-colored mycelium of the scab fungus may be present. Kernels become shrunken, white, and scabby. Infections usually start from inoculum produced on the seed or on crop residues, such as cornstalks. If wheat follows corn in the crop rotation, or is grown near corn, scab that builds up on the corn often causes severe damage to the wheat. Partial control is obtained by avoiding sowing wheat after corn and by thoroughly plowing under cornstalks. Seed should be thoroughly cleaned and treated with a recommended fungicide.

Loose Smut.—Loose smut has been a rather serious disease in the spring wheat region particularly since susceptible varieties such as Mida and Lee have been grown so extensively. This internally borne fungus starts growth with the seed, grows upward within the plant, and forms a mass of smut spores in place of the floral parts of the wheat plant at flowering time. Spores are carried away by wind, rain, insects, and other means. Infection occurs when the spores are carried to the floral parts of a susceptible, healthy plant soon after heading. Then they germinate and cause internal infection in the developing kernels. It is impossible to distinguish infected kernels from noninfected ones by external examination.

Many varieties of wheat are resistant to loose smut. Growing resistant varieties is the best method of control. Surface-applied disinfectants do not control the loose smut organism.

Small lots of seed may be treated by the modified hot-water method or by the long-soak method. The hot-water method consists of a presoak for 6 hours at 60° F., immersion for 3 minutes at 120°, 10 minutes at 129°, followed by prompt cooling and drying. The long-soak method consists of immersing the seed in water 48 to 56 hours. A modified schedule that has retained better germination in the seed consists of presoaking in water for 4 to 6 hours, draining off the water, and placing the wet seed in airtight containers for 96 to 120 hours—all at temperatures of 70° to 80° F. It is more easily applied and is replac-

ing the hot-water method. Both treatments require prompt drying of the grain. They reduce germination and are practical only as a means of providing smut-free seed for sowing on isolated seed plots.

Bunt, or Stinking Smut.—Bunt spores are carried over from crop to crop on seed. When the seed is sown in moist, cool soil, the spores germinate and enter the seedling wheat plants. The smut organism grows within the infected plants and produces "smut balls" in place of the kernels. These smut balls are grayish brown or black and are about the size and shape of wheat kernels. When crushed, they reveal a foul-smelling mass of spore dust.

Some varieties have considerable resistance to this smut, but smutty grain should be carefully fanned and treated with an effective mercurial fungicide before being sown. For further information about seed treatment, see your county agent or write to the U.S. Department of Agriculture, Washington 25, D.C.

Wheat Streak Mosaic.—Wheat streak mosaic has caused extensive losses in parts of the spring wheat region. This disease is caused by a virus and is transmitted from plant to plant by tiny mites. The mites are not visible to the unaided eye.

The leaves of diseased plants exhibit yellowish-green to yellow mottling and striping. Durum varieties are the most severely affected; hard red spring varieties rank next and winter wheats last. Plants are usually stunted and have numerous tillers that vary in height. Yield is reduced because of partial filling of the kernels, distorted heads, or failure of the heads to develop or emerge.

Control practices are mainly cultural. These include destruction of volunteer wheat plants and weeds at least 2 weeks prior to planting, sowing early in the spring, and avoiding sowing near infected winter wheat.

Other Diseases.—Black chaff is a bacterial disease. It is often confused with false black chaff, caused by an inherited factor that also produces a discoloration in certain varieties. Black chaff is found on the leaves, stems, and chaff of the wheat plant. Infected tissues become watersoaked, and a brown to black pigmentation occurs as plants mature.

Several other leaf spots, head blights, and seedling blights attack wheat occasionally. Most of these diseases can be controlled by crop rotation and other cultural practices or by treating seed with organic mercurial compounds.

Insects [2]

A number of insects attack spring wheat. Damage may be either local or widespread. In some instances, varietal resistance is useful as a control measure.

The insects that infest and damage this crop most often are grasshoppers, wireworms, the wheat stem sawfly, the armyworm, cutworms, the greenbug, the English

[2] Contributed by the Entomology Research Division, Agricultural Research Service.

498395 O—59——2

grain aphid, the hessian fly, and the wheat stem maggot. Brief discussions of these insects follow. For further information, see your county agent or write to the U.S. Department of Agriculture, Washington 25, D. C.

Grasshoppers.—During severe outbreaks grasshoppers may devour the leaves and stems and sever the heads, causing the heads to fall to the ground. Dry climate and lack of vegetation other than cultivated crops increase the loss caused by these insects. Infestations can be controlled with aldrin, heptachlor, or toxaphene.

NOTE.—A USDA motion picture on control of grasshoppers is available. For information concerning it, see your county agent.

Wireworms. — Wireworms are the larvae of the common click beetle. In infested fields the seed is attacked as soon as it is placed in the ground. The larvae may eat the entire contents of the seed, leaving only the empty husks, or they may destroy only the germ of the seed before moving to another kernel. Wireworms also feed on the crowns, roots, and basal stems, causing the plants to be yellow, weak, and stunted. To reduce wireworm damage, sow good viable seed under conditions that cause rapid germination and growth. A few extra pounds of wheat seed per acre should be sown on land known to be infested with wireworms. Seed treatments that use aldrin, dieldrin, or heptachlor give temporary protection from light infestations.

The Wheat Stem Sawfly.—The wheat stem sawfly is one of the major wheat pests in northern Montana east of the Rocky Mountains, in northern and central North Dakota, and in adjoining Canadian provinces. Although it has been most destructive in spring wheat, severe losses have occurred in winter wheat in Montana. Losses due to this insect amount to several million bushels annually in the United States. In Montana and Canada the practice of stripcropping to prevent wind erosion of the soil and to retain snow has provided ideal conditions for the sawfly. A narrow strip of wheat alternates with a strip of fallow, and the sawfly migrates from stubble to the nearby growing plants.

Injury is caused by the larvae, which tunnel and girdle the stems. Stem tunneling reduces the weight of the kernels, apparently by obstructing the normal flow of sap to the wheat heads. Crop losses caused by the breaking over of girdled stems are usually more serious than those caused by tunneling. Many of the heads on fallen stems are not recovered during harvest.

Growing resistant varieties is the most practical method of control. Two varieties, Rescue and Chinook, developed in Canada, have reduced losses in sawfly-infested areas. These wheats have yielded somewhat less than other varieties in the absence of the sawfly, and their quality is not fully satisfactory.

The Armyworm.—Damage by armyworms to spring wheat fluctuates greatly from year to year. When the insects are abundant they may be destructive over wide areas. They eat the leaves from the plant and sometimes damage the stems so that the heads fall off. They migrate from field to field. Armyworms can be controlled by spraying the crop with DDT or toxaphene as soon as the worms are found.

Cutworms.—Several species of cutworms may cause injury to wheat in the spring wheat region. Those attacking wheat may be divided into three groups—subterranean cutworms, surface feeders, and climbers. The pale western cutworm is the most destructive of the subterranean species. It can be controlled by cultivation of the wheat-stubble fields to destroy all green vegetation early in the spring as soon as the weeds and volunteer grain show 1 to 2 inches of growth, followed by a delay of 10 days before seeding to a spring grain crop. Cutworms that feed on the surface or above can be controlled with dieldrin, chlordane, DDT, or toxaphene.

The Greenbug.—The greenbug, an aphid, sometimes causes severe damage to wheat in the spring wheat region. The small, greenish, soft-bodied insect sucks the sap from the plant and injects a toxic substance into the cells. The substance causes the leaves to turn yellow. Heavy infestations kill the plants. Infestations usually result from large numbers of aphids migrating from the south.

A small parasitic wasp and lady beetles aid in keeping the greenbug under control. Cultural measures that promote rapid growth and good establishment of the wheat enable the plants to withstand injury. If neither natural nor cultural control is adequate, parathion in a spray or dust, or methyl parathion in a spray, will control an infestation. These insecticides are extremely toxic to man and livestock. They should be applied only with power equipment and should be handled with extreme care, according to the directions on the container.

The English Grain Aphid.—Damage caused by the English grain aphid is similar to that caused by the greenbug. However, this aphid usually feeds later in the season in the heads of the grain, causing the kernels to shrivel. Control methods are similar to those recommended for the greenbug.

The Hessian Fly.—The hessian fly attacks wheat in eastern Wisconsin and sometimes in other spring wheat States. Injury is caused by the feeding of the maggots between the leaf sheaths and the stems. They extract the juices of the young stems, causing the death of small tillers and so weakening the older stems that they break over shortly before harvest when the heads have grown heavy with grain.

Crop rotation, killing volunteer wheat, and plowing under infested stubble after harvest are the chief methods of control. Some varieties of spring wheat show more tolerance to hessian fly injury than others.

The Wheat Stem Maggot.—The wheat stem maggot often produces a conspicuous type of damage, but loss rarely amounts to more than 1 or 2 percent. The maggots are the larvae of a small green and black fly that lays its eggs on the leaves. The young maggot, on hatching, works its way inside the leaf sheath to the top node, where it severs the stem. The heads die and turn white. There is no practical control measure for this insect.

Weeds

Weeds are abundant in many fields in the spring wheat region. The most harmful perennial weeds are sowthistle, field bindweed, and quackgrass. These are difficult to eradicate or control. The most troublesome annual weeds include wild mustard, wild oats, Frenchweed, foxtail, Russian-thistle, and wild buckwheat. The use of a well-adapted variety and of weed-free seed of high germination helps to get the crop off to a good start. Good farming methods, and the use of recommended chemical sprays, help to keep weeds in check. Information on the use of chemical sprays may be obtained from your county agent or from the U.S. Department of Agriculture, Washington 25, D.C.

Varieties of hard red spring wheat

The popularity of different spring wheat varieties has changed rapidly since 1934, as shown in table 1. The development of improved varieties and disease injury to certain varieties brought about this change. New rust races have made obsolete many varieties that previously were little affected by rust.

Marquis occupied 60 percent or more of the hard red spring wheat acreage from 1919 to 1934, but it occupied only 1.8 percent of the acreage in 1954. Ceres occupied 31.5 percent of the acreage in 1934. Both Marquis and Ceres were injured severely by a stem rust epidemic in 1935 and were replaced by Thatcher, a rust-resistant variety. Since Thatcher was susceptible to leaf rust, it shifted largely to the western, drier part of the spring wheat region, where leaf rust is less prevalent.

Varieties having Hope or H44 as one parent, including Rival, Pilot, Rushmore, Mida, Regent, and Redman, increased in acreage and were resistant to both leaf and stem rust until 1944. These varieties declined rapidly in acreage after stem rust race 15B became prevalent in 1950. Lee assumed part of this acreage because of its leaf rust resistance and relatively higher yield in the presence of stem rust race 15B. It is susceptible under heavy rust conditions.

Mida occupied almost one-third of the bread wheat acreage in 1949 but lost popularity after 1950 because of its susceptibility to certain races of both leaf and stem rust.

Rushmore was grown on about 15 percent of the hard red spring wheat region in 1954. It is susceptible to common races of the rusts but

TABLE 1.—*Percentage of the total hard red spring wheat acreage occupied by each variety of that class in the United States at 5-year intervals since 1919, and the estimated acreage for 1954*

Variety	Percentage of acreage [1]								Acreage, 1954
	1919	1924	1929	1934	1939	1944	1949	1954	
Lee								28.9	3,838,783
Thatcher				(*)	41.6	28.3	19.1	19.2	2,537,260
Rushmore							.1	15.2	2,014,586
Mida						.1	31.4	11.8	1,558,910
Rescue							5.2	5.1	676,314
Ceres			2.6	31.5	27.0	10.3	6.7	4.7	621,883
Rival					(*)	25.8	16.6	3.6	480,423
Cadet							3.5	1.9	263,900
Marquis	71.4	85.4	87.4	60.2	24.3	9.7	5.0	1.8	237,236
Pilot					(*)	7.7	3.2	1.4	184,092
Henry						(*)	1.0	1.1	146,904
Redman							.8	1.1	144,561
Spinkcota							.1	.6	77,896
Regent						8.5	2.5	.5	60,677
Saunders								.5	60,464
Komar				.1	.8	.4	.3	.3	43,123
Supreme			2.2	1.3	.8	.3	.4	.3	36,491
Newthatch						(*)	1.6	.3	35,847
Vesta						2.5	.6	.2	20,876
Red Thatcher								.2	20,023
Selkirk								.1	15,548
Huston [2]	.1	.2	.1	.1	.1	(*)	(*)	.1	10,780
Premier						.2	1.0	.1	8,095
Chinook								(*)	7,986
Reward			.1	1.6	1.5	1.5	.6	(*)	6,048
Renown					.4	3.5	.1	(*)	2,574
Apex					(*)	.2	(*)	(*)	1,663
Kinney [2]	.2	.1	.1	.1		(*)	(*)	(*)	1,520
Sturgeon				(*)	(*)	(*)	(*)	(*)	465
Red Bobs		.1	.1	.1	.1	.1	(*)	(*)	391
Progress		(*)	.2	.7	.4	.1	(*)	(*)	121
Canus						(*)	.1		
Carleeds							.1		
Kitchener		(*)	(*)	(*)	(*)	(*)	(*)		
Marquillo			.1				(*)		
Comet							(*)		
Variety not reported [3]								1.0	132,964
Total	71.7	85.8	[illegible]	[illegible]	[illegible]	99.6	100.0	100.0	13,248,404

[1] The asterisk (*) indicates the variety was reported as grown, but the estimate of acreage was less than 0.1 percent.
[2] Soft red spring wheat.
[3] Derived by apportioning to each of the five principal market classes all wheat acreage for which the variety was not reported.

has yielded well in South Dakota, probably because of its earliness.

Spinkcota also increased in acreage because of its tolerance to rust or ability to produce a crop under adverse rust conditions in eastern South Dakota.

Selkirk has increased rapidly in the eastern section of the spring wheat region, occupying an estimated 7 million acres in 1957. This variety is moderately resistant to many races of both rusts. Another variety, Conley, released to farmers in 1956, is also resistant to stem rust but is moderately susceptible to leaf rust and false black chaff.

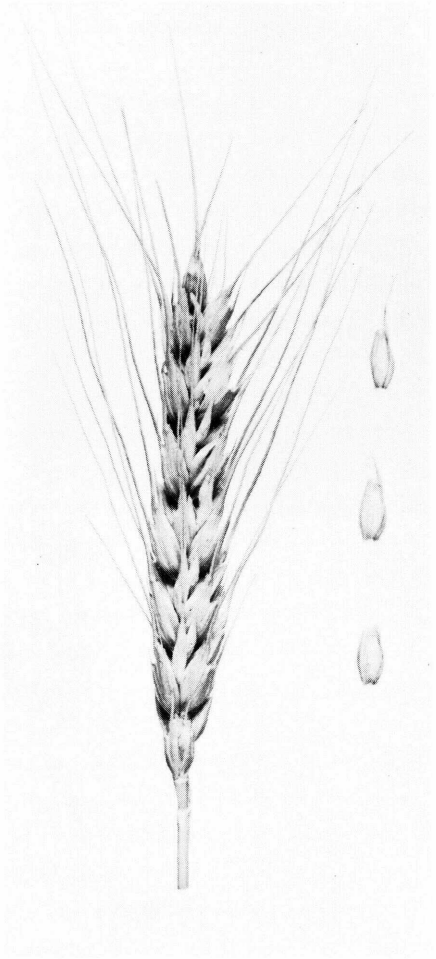
No varieties are resistant to all races of any disease or to all diseases that attack the wheat plant. New varieties that are resistant to the prevalent races of disease may be susceptible to new races or to rare races that increase in prevalence with changes in varieties. Consequently, new varieties with resistance to diseases and insects must be developed from time to time as new races or new diseases or new insects occur. Since all the

older commercial varieties are susceptible to stem rust race 15B, it is anticipated that Selkirk and Conley will replace most of them where this disease is a serious problem.

Lee.—Lee was the leading variety of hard red spring wheat in 1954. It was bred by the Minnesota Agricultural Experiment Station and the U.S. Department of Agriculture, and was first distributed to farmers in 1950. It has increased in acreage because of (1) its resistance to leaf rust and to many races of stem rust, (2) good yield, and (3) slightly higher test weight than other varieties. However, it is only slightly resistant to stem rust race 15B. Lee was grown on approximately 4 million acres in 1954, and is recommended in Minnesota, South Dakota, North Dakota, Montana, Nebraska, and Colorado.

Lee is relatively early in maturity and has medium-strength straw. The variety is bearded and has smooth, white chaff and hard, red kernels (fig. 3). It is noted particularly for its leaf rust resistance. It is moderately resistant to stinking smut and is susceptible to scab and loose smut. The quality of Lee wheat for milling and baking is considered to be equal to that of Thatcher. However, considering its high protein content, the loaf volume is not as large as one would expect.

Lee is a selection from a cross of Timstein with Hope. The Timstein parent was bred in Australia and is resistant to a large number of races of both leaf and stem rust.



BN-6506

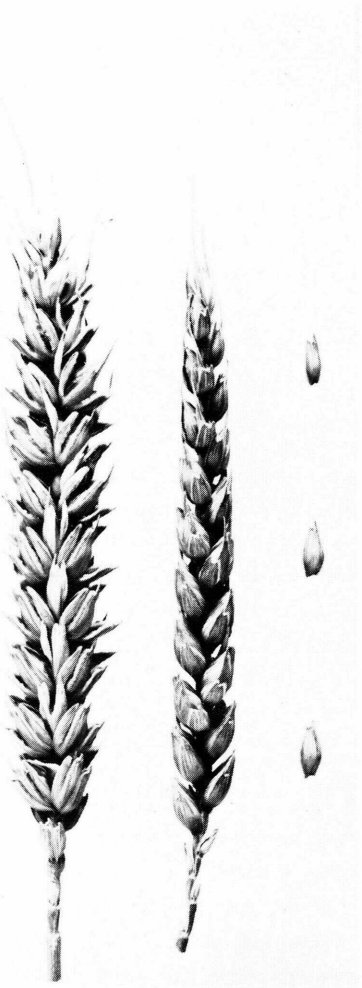
FIGURE 3.—Spike of Lee wheat.

Thatcher.—Thatcher was the second most important hard red spring wheat variety in 1954. It was produced by the Minnesota Agricultural Experiment Station and the U.S. Department of Agriculture. It was distributed to farmers in 1934. It occupied about 42 percent of the spring wheat acreage in 1939, principally because of the protection it gave against stem rust. An additional 10 million acres were

grown in Canada. It was estimated that 17 million acres were grown in the United States and Canada in 1940. The acreage of Thatcher in the United States declined to 19.2 percent of the spring wheat acreage in 1954 largely as a result of 15B rust, to which Thatcher is susceptible.

Thatcher is relatively early in maturity, has short, stiff straw, and is able to stand up when other varieties lodge. It is beardless and has smooth, white chaff and hard, red kernels (fig. 4). It is a widely adapted variety and seems to have drought resistance. Leaf rust, though not so destructive as stem rust, occasionally is responsible for low yields and light test weights of Thatcher. The variety is susceptible to certain races of stinking smut and to scab and mildew. In dry years Thatcher may be too short for convenient harvesting; also, many farmers prefer a bearded type, especially for windrowing. Thatcher wheat tends to have low test weight and to bleach when frequent rains occur between ripening and threshing.

The kernels of Thatcher are sometimes dull in appearance and not quite so attractive as those of some other varieties. The quality of Thatcher wheat for milling and baking is considered very good; it makes a stronger flour than does the Marquis variety. In some dry years the flour, probably because of its unusually high protein content, has been too strong or "bucky" and consequently had to be blended with weaker wheats for the most satisfactory results.



BN–6539X

FIGURE 4.—Spikes of Thatcher wheat.

The development of Thatcher wheat extended over a long period, starting with the introduction of Iumillo durum wheat from Italy in 1901, followed by the discovery of the resistance of this variety to stem rust in 1904. Iumillo was first crossed with Marquis in 1914, and a selection from the resulting hybrid was crossed in 1921 with a selection from a hybrid between

Marquis and the winter wheat Kanred. The final selection from the 1921 cross, which resulted in Thatcher, was made in 1925. It was distributed and recommended for growing in 1934. Following the rust epidemic of 1935, it spread rapidly into the Dakotas and Canada, where stem rust had caused severe crop losses. Because of its leaf rust susceptibility, it was soon replaced by leaf rust-resistant varieties in the eastern part of the area, but it has been widely grown in the western part of the spring wheat region, particularly North Dakota, South Dakota, Montana, Colorado, and Wyoming.

Rushmore.—Rushmore was developed at the South Dakota Agricultural Experiment Station from a cross of Rival×Thatcher made in 1937, and was distributed in 1949. The desirable characters of this variety are early maturity, fair strength of straw, a fair yield, good quality, and resistance to stem rust (except race 15B). This variety has been well adapted to South Dakota, where it has given a fair yield and test weight even when stem rust race 15B was prevalent. It also is recommended in Nebraska. This variety is severely injured by both leaf and stem rust when the infection is heavy, as in 1954. It is moderately resistant to stinking smut and to loose smut, but is susceptible to scab. Rushmore is beardless, white glumed, of medium height, and high in bushel weight (fig. 5). It has good milling and baking qualities.

BN–6502

FIGURE 5.—Spikes of Rushmore wheat.

Mida.—Mida was developed by the North Dakota Agricultural Experiment Station in cooperation with the U.S. Department of Agriculture from a cross between Mercury and Ceres-Double Cross. Mercury was developed at the North Dakota Agricultural Experiment Station from a cross between Ceres and a selection from Hope-Florence. Double Cross was a selection from the Marquis-Iumillo ×Marquis-Kanred hybrid from which Thatcher was selected. The

cross from which Mida was selected was made at Fargo, N. Dak., in 1933. An F_5 selection, made in 1936, was named Mida in 1944 and distributed to farmers in North Dakota that year. It became the most widely grown hard red spring wheat in 1949. Its acreage declined because of serious injury by the rusts and occupied only 11.8 percent of the spring wheat acreage in 1954. It is recommended in North Dakota and Wyoming.

Mida is a midseason, often purple-stemmed variety. It is of medium height and has medium-strong straw and smooth, white, glabrous glumes. The variety is bearded and has large, red kernels (fig. 6). Mida sometimes has black awns, and usually has a high test weight when not injured by disease. It is susceptible to stem rust race 15B but has resistance to some races of bunt, leaf rust, and stem rust. It is susceptible to loose smut and shattering. The quality of Mida is good, although the gluten is not so strong as in Thatcher.

BN–6504

FIGURE 6.—Spike of Mida wheat.

Rescue.— Rescue was developed at the Dominion Experimental Station at Swift Current, Saskatchewan, Canada, from a cross between Apex and S–615, made at Ottawa in 1938. This variety was selected for its resistance to the wheat stem sawfly and has solid stems like the S–615 parent, which was introduced from New Zealand. Two bushels of seed were furnished Montana in the fall of 1944. Two crops per year were grown—one in the winter in Arizona and one in the summer in Montana—until the seed supply was increased to 60,000 bushels. Rescue was released for commercial seeding in Montana in 1947. It is recommended that Rescue be grown only where the sawfly

498395 O—59——3

is prevalent, because it does not yield so well as other adapted varieties where the sawfly is not destructive. It is not fully satisfactory in quality.

Rescue is awnless, midseason to late, and tall. It has white, weak, solid stems. The glumes are white and glabrous, and the kernels are short, hard, and red (fig. 7). It has some resistance to stem rust (except 15B) and is susceptible to leaf rust and bunt. It has a low protein content and is not considered equal to Thatcher in breadmaking quality, although the loaf volume is good.

Ceres.—Ceres was developed at the North Dakota Agricultural Experiment Station from a cross made between Marquis and Kota in 1918 and was distributed in 1926. The desirable characters of this variety are medium maturity, fair strength of straw, high yield, and high quality. The acreage increased until 1934 when 8,510,141 acres were grown in the United States. Following a heavy stem rust epidemic in 1935, the acreage declined and by 1949 slightly over 1 million acres were sown. It is now largely grown in the western Dakotas and Montana, where rust usually is not serious. The quality of Ceres has been accepted by the commercial trade as substantially equivalent to Marquis. Ceres is a midseason variety. It is of medium height and has white, medium-strong straw. It is awned and has white, glabrous glumes. The kernels are red, hard, and medium sized.

Rival.—Rival was developed in cooperative experiments conducted by the North Dakota Agricultural Experiment Station and the U.S. Department of Agriculture. It is a selection from Ceres crossed with Hope-Florence, made in 1929. The variety was released to North Dakota wheatgrowers in 1939.

BN-6506

FIGURE 7.—Spikes of Rescue wheat.

Rival is a bearded variety, moderately resistant to bunt and loose smut, moderately susceptible to leaf and stem rust and scab, and susceptible to black chaff. It is medium early and has tall, weak straw. The kernels are red, hard, and large;

they have a tendency to shatter and to sprout during a wet harvest. The acreage has been greatly reduced because of the variety's susceptibility to stem and leaf rust. Rival has a higher test weight than Thatcher and is about equal to it in milling and baking characters. It is grown principally in North Dakota.

Cadet.—Cadet is a selection from a cross of Merit with Thatcher made in 1936 by the U.S. Department of Agriculture. It was selected for several generations at experiment stations in North Dakota and Montana. One selection, later named Cadet, was released to farmers in North Dakota in 1946. That State and Wyoming recommend this variety.

Cadet is a beardless, white-glumed, late-maturing variety. It has strong straw and does not shatter easily. The kernels are short and red. It is resistant to stem rust (except 15B) and to some races of leaf rust, loose smut, and mildew. It is taller and 3 to 4 days later than Thatcher. Cadet has satisfactory milling and baking characteristics. The grain is small and the test weight is often lower than for many of the other varieties. The acreage of Cadet has decreased since 1950.

Marquis.—Marquis was selected from a cross between Red Fife and a hard red spring wheat from Calcutta, India. The cross was made about 1892, probably at the Experimental Farm at Agassiz, Canada, and the strain selected was named Marquis. It was released in Canada in 1909 and in the United States in 1913.

In comparison with other varieties of hard red spring wheat that were available when it was released, Marquis ranked high in quality, average yields, and earliness of maturity. It was also a widely adapted variety. For these reasons the acreage increased rapidly. The acreage decreased after 1928 because of the variety's susceptibility to leaf and stem rust. It was largely replaced first by Ceres and later by Thatcher. In 1954 about a quarter of a million acres were grown in the western part of the spring wheat region.

The Marquis variety is awnless and has rather short straw. It has white, glabrous glumes and short, hard, red kernels. It has long been regarded as the standard of quality for breadmaking and as superior in this respect to most of the older varieties of wheat grown in the United States.

Pilot.—Pilot wheat, developed by the U.S. Department of Agriculture and the North Dakota and other State agricultural experiment stations, was distributed in North Dakota, South Dakota, and Montana in 1939. It was selected from a Hope-Ceres cross made in 1926.

Pilot is a high-yielding variety of satisfactory milling and baking quality. It is bearded, midseason, and of medium height. It has purple, weak straw. The grains are medium sized, red, and hard. Pilot is susceptible to stem rust race 15B but is resistant to some races of leaf rust, stem rust, bunt, and powdery mildew.

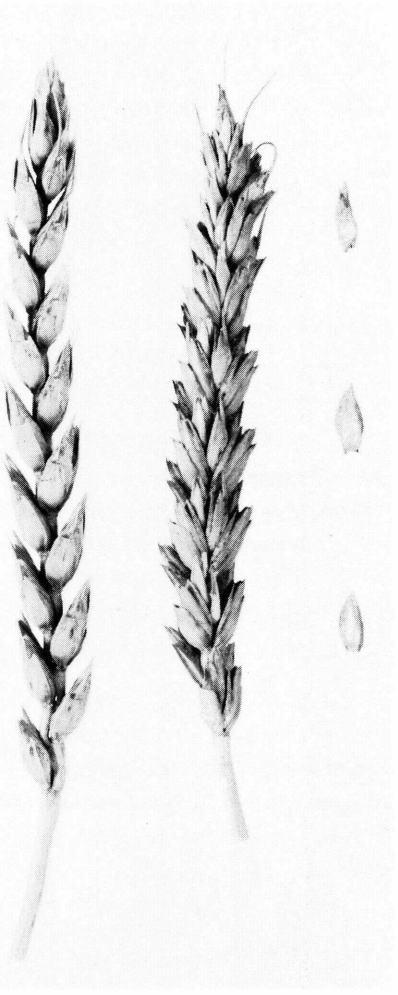
The variety was recommended for northern and western North Dakota, northern South Dakota, western and southern Montana, and northeastern Wyoming, but the acreage has decreased since 1944, partly because of its susceptibility to leaf rust and to stem rust race 15B.

Redman.—Redman was developed at the Dominion Laboratory of Cereal Breeding at Winnipeg, Manitoba, Canada, from a cross between Regent and Canus made in 1934. It was first released in 1945, and a selection was distributed in 1947.

Redman is awnleted and early. In height it is short to medium. It has medium straw strength, and has white, glabrous glumes. The kernels are short, red, and hard. This variety is susceptible to stem rust race 15B, but is resistant to bunt and to some races of leaf rust, stem rust, and loose smut. It has very good milling and baking characteristics.

Selkirk.—Selkirk was developed at the Dominion Rust Laboratory at Winnipeg, Manitoba, Canada, from a cross made in 1939 involving the McMurachy and Exchange varieties. Selections from this cross were backcrossed to Redman three times—in 1944, 1945, and 1946. Selkirk was released to farmers in 1953. It is very similar to Redman in appearance.

Selkirk is an awnleted, medium-early variety. It is resistant to lodging, shattering, and sprouting. The glumes are white and smooth, and the kernels are hard, medium sized, and red (fig. 8).



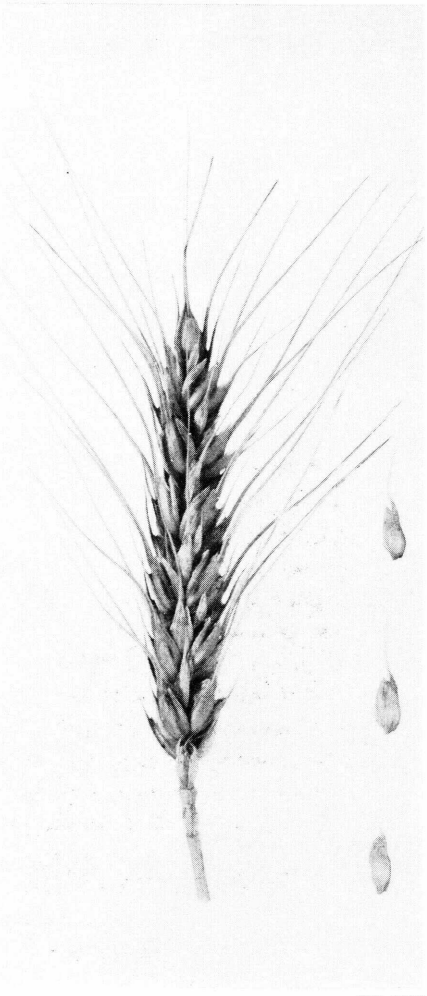
BN–6501

FIGURE 8.—Spikes of Selkirk wheat.

At moderate temperatures this variety resists stem rust, including many of the prevalent strains of race 15B. Selkirk is susceptible to some races of rust at higher temperatures. It has moderate resistance to leaf rust, and resistance to bunt and loose smut.

Selkirk has been somewhat low in both yield and test weight when grown under droughty conditions or in hot weather. The seed of Selkirk was increased rapidly in the United States and Canada after its release, and adequate supplies became available for 1956 seedings. The milling and baking characteristics are satisfactory. Selkirk largely replaced other commercially grown bread wheats in 1957 in the area where stem rust has been a problem.

Conley.—Conley was developed by crossing Thatcher with an unnamed selection resembling Selkirk in pedigree, and by crossing the resulting cross with Lee. The breeding was done at the North Dakota Agricultural Experiment Station in cooperation with the U.S. Department of Agriculture. The variety was named and released to farmers in 1956, and about 100,000 acres were grown in 1957. The variety is awned; has white, glabrous glumes and red kernels; is midseason to late; is tall; and has medium-strong straw (fig. 9). It is resistant to stem rust, including race 15B, and bunt, but is susceptible to leaf rust and moderately susceptible to loose smut. This variety was injured by black chaff and false black chaff in many tests in 1955. It has satisfactory milling and baking characteristics, and has mixing tolerance comparable to that of Thatcher. Its gluten is very strong.



BN–6497

FIGURE 9.—Spike of Conley wheat.

Henry.—Henry was developed from a cross between a selection of Illinois No. 1-Hope and a selection of Webster-Resaca, made in 1933 at the Wisconsin Agricultural Experiment Station in cooperation with the U.S. Department of Agriculture. It was released to farmers in Wisconsin in 1944.

Henry is a bearded, midseason variety; is medium in height; and has medium-strong, purple stems and white, glabrous glumes. The kernels are red, semihard to hard, and medium sized.

Henry is resistant to stem rust (except 15B) and bunt and is moderately susceptible to loose smut. It is about 3 days later than Lee and has been a high-yielding variety. The variety sometimes shows false black chaff. Because of its soft-kernel characteristics, it is not a good milling wheat when grown in the spring wheat region. It is recommended, however, as a feed wheat in certain States, particularly in Wisconsin. About 146,900 acres were grown in 1954.

Spinkcota.—Spinkcota was developed by a private breeder at Redfield, S. Dak., and distributed in 1944. The parentage is reported as (Preston selection × red durum) × a Preston selection.

This is a bearded, midseason, tall, white-stemmed variety. The straw is medium strong; the glumes are white and glabrous. The variety has a long type of head, and the kernels are medium sized and red.

Spinkcota is susceptible to the rusts, but it exhibited some tolerance during 1950-to-1954 epidemics of stem rust race 15B, and farmers in the vicinity of Redfield, S. Dak., reported better yields and test weight from this variety than from the other commonly grown bread wheats. The variety has poor breadmaking qualities and often is subject to discount on the market. It is not on any recommended list. Less than 100,000 acres of this variety were reported in 1954.

Russell.—Russell was developed by the Wisconsin Agricultural Experiment Station in cooperation with the U.S. Department of Agriculture. It is a selection from a cross of Thatcher × W38-Hope.

Russell's resistance to loose smut, powdery mildew, and the hessian fly, along with its moderate resistance to the most prevalent races of stem rust, including race 15B, makes it a high-yielding variety that should be useful as a feed wheat in the eastern part of Minnesota and in Wisconsin and Michigan. The variety is susceptible to leaf rust and is moderately susceptible to bunt. Its milling and baking characteristics are only fair. Russell is slightly later and taller than Henry and has weaker straw.

Other Varieties.—A number of other varieties have performed well in certain areas and were satisfactory before the occurrence of races of leaf rust and stem rust that attack them. Others are unsatisfactory for milling and baking. Each of these varieties was grown on less than 100,000 acres in 1954 (table 1). None of these is recommended. Eighteen bread wheats reported as being grown in 1939 were not reported in 1954.

Varieties of durum wheat

The principal varieties of durum wheat grown in the North Central States are listed in table 2.

Mindum was the most popular durum variety in 1934, 1939, and 1944, and it occupied 69.6 percent of the durum acreage in 1954. Stewart was the most popular variety in 1949. The acreage of Mindum increased after 1949, whereas that of Stewart, Carleton, and Ku-

TABLE 2.—*Percentage of the total durum wheat acreage occupied by each variety of that class in the United States at 5-year intervals since 1919, and the estimated acreage for 1954*

Variety	Percentage of acreage [1]								Acreage, 1954
	1919	1924	1929	1934	1939	1944	1949	1954	
Mindum		0.3	5.5	15.9	22.5	31.2	27.4	69.6	1,108,131
Stewart						.6	37.6	15.9	253,624
Vernum							.4	6.6	104,801
Kubanka	1.2	11.6	12.5	24.6	12.8	8.3	7.8	4.0	64,281
Carleton						.3	15.8	1.5	24,023
Nugget								.6	9,922
Stewart 221								.2	3,013
Sentry (Ld. 356)								.2	2,336
Ld. 357								.1	733
Barnatka								(*)	176
Pentad (red durum)	1.1	8.2	17.3	11.1	18.3	9.1	8.1		
Peliss	.1	.1	.1	.9	.4	3.5	.4		
Arnautka	.3	.6	.3	.7	.2	(*)	.1		
Nodak		(*)	.6	.6	.1		(*)		
Varieties not reported [2]	96.8	74.5	60.3	41.7	44.6	46.8	2.4	1.3	20,132
Total	99.5	95.3	96.6	95.5	98.9	99.8	100.0	100.0	1,591,172

[1] An asterisk (*) shows that the indicated variety was grown, but that the estimated acreage was less than 0.1 percent.
[2] Derived by apportioning to each of the five principal market classes all wheat acreage for which the variety was not reported.

banka decreased. All the durum varieties reported grown in 1954 are susceptible to stem rust race 15B and have been damaged severely by it. Apparently Mindum was less affected than the other varieties, although it gives a fully susceptible reaction.

Vernum increased in popularity after 1950 because its earliness enabled it to escape some rust damage. The hard-threshing characteristic of Stewart is increased when the grain is shrunken from stem rust injury, and this probably has reduced its popularity.

Surveys show an increasing recognition of the different varieties of durum wheat. In 1919, 97 percent of the durum acreage was sown to unknown varieties. By 1954, only 1.3 percent was sown to unknown varieties.

Seed of durum varieties resistant to stem rust race 15B was not available in 1954 but seed of Sentry and Ld. 357, varieties with some tolerance to race 15B, was made available to farmers that year. The moderately rust-resistant varieties, Langdon, Yuma, Ramsey, and Towner, are recommended for the rust area. The Langdon variety was seeded on approximately 50,000 acres in 1956, and by 1957 enough seed of varieties resistant to 15B was available for sowing most of the durum acreage.

The durum varieties listed in table 2 are not resistant to stem rust race 15B and are not recommended for growing where rust damage is likely to occur, but several of them may be recommended for areas in which race 15B is not a major hazard. The newest resistant varieties are to be preferred where stem rust is prevalent.

Mindum.—Mindum was originally selected as a durum mixture from a field of common wheat in 1896 and was distributed to farmers

BN–6540X

FIGURE 10.—Spikes of Mindum durum.

by the Minnesota Agricultural Experiment Station in 1917. The popularity of Mindum is due to its high yield and good quality. It has been considered a standard for quality by millers and macaroni manufacturers for many years.

Mindum is susceptible to stem rust races 15B and 17, which have reduced its yield during rust epidemics caused by these races. It has awns; smooth, yellowish chaff; and large, white (amber) kernels (fig. 10). Compared with hard red spring wheat varieties, it matures later, has longer straw, and is more inclined to lodge.

Stewart.—Stewart was developed by backcrossing Mindum on selections from a cross between Mindum and Vernal emmer at the North Dakota Agricultural Experiment Station in cooperation with the U.S. Department of Agriculture. The first cross between Mindum and Vernal emmer was made in 1930. A selected F_4 plant was backcrossed to Mindum in 1933, from which an F_4 plant was again backcrossed to Mindum in 1936. An F_4 selection of this second backcross was tested, increased, and named Stewart. In 1954 it was grown on 253,624 acres.

Stewart is resistant to prevailing stem rust races other than 15B. It is resistant to leaf rust and has some resistance to bunt. It is similar to Mindum in strength of straw and in macaroni quality. It is about 1 day later than Mindum and is more resistant to shattering. Its tendency to shed its awns at maturity gives the spikes an irregular appearance. It has smooth, yellowish chaff and large, white (amber) kernels (fig. 11).

Vernum.—Vernum also was developed by backcrossing Mindum

with selections from crosses between Mindum and Vernal emmer at the North Dakota Agricultural Experiment Station in cooperation with the U.S. Department of Agriculture. Early-maturing, stem rust-resistant selections were backcrossed to Mindum four times. Vernum was distributed in 1947 for growing in South Dakota and the southern part of North Dakota, and it increased from 13,392 acres in 1949 to 104,801 acres in 1954.

Vernum is 2 or 3 days earlier than Mindum and has slightly shorter and weaker straw. It is resistant to leaf rust and the prevailing races of stem rust, other than 15B. It is satisfactory for the making of macaroni. It has awns; smooth, yellowish chaff; and large, white (amber) kernels.

Sentry.—Sentry was named and released in 1954, and 2,336 acres were reported grown that year. It was developed by the North Dakota Agricultural Experiment Station in cooperation with the U.S. Department of Agriculture. It is a selection from a cross made in 1948 between Nugget and an unnamed experimental variety from the double cross Heiti-Stewart×Mindum-Carleton. Heiti is an early-maturing, erect, short-strawed variety introduced into this country from Australia.

Sentry is about 5 days earlier than Mindum, 5 to 9 inches shorter, and much more resistant to lodging. Its combination of earliness with some tolerance to stem rust race 15B enables it to escape much of the damage in stem rust years. It was grown on approximately 150,000 acres in 1957.

BN—6505

FIGURE 11.—Spike of Stewart durum.

Blacktip fungus discolors the germ tips in some years. Sentry yields well, has high test weight,

BN-6498

FIGURE 12.—Spike of Sentry durum.

and produces semolina and macaroni products of good quality. It has smooth, yellowish chaff and large, white (amber) kernels (fig. 12). Its tendency to shed its awns at maturity gives the spikes an irregular appearance.

Langdon.—Langdon was released by the North Dakota Agricultural Experiment Station and the U.S. Department of Agriculture in 1955. It was developed by backcrossing a Khapli emmer-durum hybrid selection with three related durum varieties. The first cross between an unnamed selection from a Mindum×Carleton hybrid and Khapli emmer was made in 1944. The first backcross was made in 1949 with the same unnamed experimental variety used to breed Sentry, the second backcross with Stewart in 1950, and the third backcross with Carleton in 1951. Langdon was grown on an estimated 840,000 acres in 1957.

Langdon is more susceptible to leaf rust than the other durum varieties mentioned in this bulletin. It is moderately resistant to stem rust race 15B, and highly resistant to all other prevalent races. It is about 2 days earlier than Mindum. It has shorter straw and greater resistance to lodging than Mindum but is not equal to Sentry in these characteristics. It has smooth, yellowish chaff and large, white (amber) kernels (fig. 13). Its tendency to shed its awns at maturity gives the spikes an irregular appearance. It has good yielding ability and semolina quality.

Yuma.—Yuma is a selection from the first backcross involved in the development of Langdon. It was named and released by the North Dakota Agricultural Experiment Station and the U.S. Department of Agriculture in 1955.

Yuma has more resistance to stem rust than any of the other durum varieties discussed. It is nearly as resistant as Khapli emmer. Like

BN–6499

FIGURE 13.—Spike of Langdon durum.

BN–6500

FIGURE 14.—Spike of Yuma durum.

Langdon, it is somewhat susceptible to leaf rust. Yuma is about 2 days earlier than Mindum. It has about the same straw strength as Mindum but is 6 to 8 inches shorter. It is acceptable, but is not equal to Langdon and Mindum for yield, test weight, and semolina quality. It has smooth awns, white chaff, and large, white (amber) kernels (fig. 14). An estimated 200,000 acres was grown in 1957.

Ramsey.—Ramsey is a selection from a cross of Carleton with P.I. 94701, which is a durum introduction from Palestine that was resistant to stem rust race 15B in 1950. This cross was made in 1950, and Ramsey was named and released in 1955 by the North Dakota Agricultural Experiment Station and the U.S. Department of Agriculture.

Ramsey matures about 1 day earlier than Mindum, is 1 to 2 inches

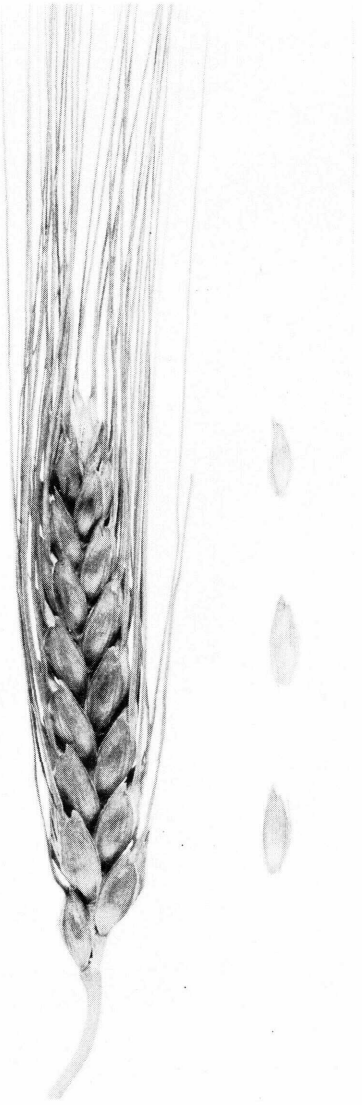
shorter in straw length, and is slightly more resistant to lodging. It has good yielding ability, test weight, and semolina quality. A spike of Ramsey appears in figure 15.

Ramsey was resistant to stem rust race 15B from 1950 to 1954, but in 1956 another strain of 15B attacked Ramsey. It was grown on about 400,000 acres in 1957.

Towner.—Towner is from the same cross as Ramsey. It was released at the same time as Ramsey and by the same agencies. It is similar to Mindum in maturity and in height and strength of straw. It has high test weight and a smooth kernel type. Like Ramsey, it is susceptible to certain cultures of 15B and, therefore, is not sufficiently resistant to stem rust. The estimated acreage in 1957 was 140,000 acres.

Other Varieties. — Kubanka, Carleton, Nugget, Stewart 221, and Ld. 357 are other varieties grown in 1954 (table 2) that produce grain of good macaroni quality. Each of these varieties is excelled—in a desirable combination of plant characteristics, disease resistance, and performance—by one or more of the varieties already discussed. Golden Ball has black awns and pubescent chaff. It has some tolerance to 15B stem rust, but it is unsatisfactory in macaroni quality.

The Barnatka, Pentad, Peliss, Arnautka, and Nodak varieties are below present-day standards for both performance and quality and should no longer be grown.



BN–7559–X

FIGURE 15.—Spike of Ramsey durum.

U. S. GOVERNMENT PRINTING OFFICE: 1959 O—498395